

5.01 General

The National Bridge Inspection Standards (NBIS) requires a load rating be calculated for each bridge as well as a scour evaluation for any structure over water.

The load rating calculations and scour evaluations are a permanent part of the bridge file and are to be updated when the condition of the bridge changes. All load rating calculations shall be stamped, signed, and dated by a registered professional engineer.

5.02 Bridge Load Rating

Load rating of bridges shall be completed per Chapter 13 of the *Bridge Design Manual* M 23-50 and the AASHTO *Manual for Bridge Evaluation* (MBE). See the appendix in the MBE for examples of load rating different types of structures.

A. General Load Rating and Re-Rating Guidelines

- The Load rating of new bridges shall be completed within 90 days of opening the structure to the traveling public in the anticipated final configuration.
- The ratings of existing bridges shall be re-examined when the “Revise Rating Flag” is turned on. The condition of identified bridge elements shall be reviewed and the load ratings shall be updated if needed. In cases where the capacity of a member is reduced significantly, such as impact damage to a girder with loss of reinforcing or damage to steel members, ratings shall be updated within 30 days. In other cases such as increase in dead load, a preliminary assessment can be made based on the increase in dead load, condition of the structure and existing ratings. If in the engineer’s judgment, the ratings will not be affected significantly, and will not require a need to post or lower the load restriction on the bridge, ratings should be updated within 12 months.

B. Bridge Load Rating Revision Criteria

WSBIS element WB76, Item 88, Revise Rating should be coded as “Y” when one or more of the following items apply:

1. The Superstructure or Cross-beams/ Floor-beams Elements’ State condition changes from either Condition State 1 or State 2 to Condition State 3 or State 4.
2. The approach condition to the structure causes severe impact to the bridge. An option is to call for a high priority repair to fix the approaches so the transition onto the structure is smooth.
3. The deck has potholes on the surface or at the joints. An option is to call for a high priority repair to patch the potholes in the deck at the joints.

4. The thickness of the overlay has increased.
5. The railing is replaced with a heavier traffic barrier.
6. New utilities such as water main or sewer line have been installed on the structure.
7. The number of striped lanes has increased on 2 line superstructure members such as trusses or 2-line girder bridge, and box girder bridges.

When a deficiency is observed in the field such as rot pockets in timber or section loss in a steel member, the inspector should provide the following items to assist in providing accurate rating factors:

1. The description “shell thickness” shall state whether the thickness is all around the member or on one side and whether it is full depth and location.
2. Section loss in steel members should include, if possible, the remaining section thickness, location of the section loss and length.

Provide a sketch of the deficient member and show deterioration as stated above and provide length of the deteriorated area. It is of great importance to provide as accurate information as possible instead of estimates. Posting or restricting a bridge is greatly dependent on this information.

C. Bridges With Unknown Structural Components

For concrete and masonry bridges with no design plans, and when the necessary reinforcing details are unknown and cannot be measured, load capacity ratings may be determined based on field inspection by a qualified bridge inspector followed by evaluation by a qualified engineer. Such a bridge does not need to be posted for load restrictions if it has been carrying normal traffic for an appreciable period of time and shows no sign of distress; Reference the manual for bridge Evaluation (MBE) second edition, Sections 6.1.4 and 6A.8.1. General rating guidelines for these structures are:

- Inventory rating shall be equal to the design truck at the time the bridge was constructed. Operating rating shall be equal to the inventory rating multiplied by 1.667.
- Legal trucks rating factors shall be equal to 1 when the Superstructure or Substructure NBI code is equal or greater than 5. Restriction of permit loads shall be assessed.
- Posting or restricting of a bridge shall be assessed when NBI condition rating of the superstructure or substructure is 4 or less or when there are signs of structural distress.

The Load Rating Methods WB75-51 and WB75-54 shall be coded as “A”, Administrative.

Full documentation for an administrative rating shall be placed in the bridge file.

D. Data Management

The WSBIS database shall be updated within 30 days from the completion and approval of a load rating of a structure.

E. Posting Requirements

Posting of a structure shall occur when the Operating rating factor for any of the legal loads is less than 1 based on the Load Factor or Allowable Stress Methods or the rating factor for any of the legal loads is less than 1 based on the Load and Resistance Factor Method.

Agencies generally post a bridge between the Inventory Rating and the Operating Rating using the Load Factor Method and Allowable Stress Methods. The minimum permissible posting value is three tons at inventory or operating levels. Bridges not capable of carrying a minimum gross live load of three tons shall be closed. The posted tonnage shall be the smaller of the rating factor for the specific truck times its weight or the gross vehicle weight of the truck.

In general, posting of a structure, when warranted, shall occur within 60 days from the date of the letter sent to the region or the date the local agency is notified by the engineer. In instances where the load carrying capacity of a bridge is significantly reduced, such as by impact to the structure, posting or closing of the bridge shall occur as soon as it is determined it is not safe to carry legal vehicular loads.

F. Overload Permits

Overweight loads traveling over state or local agency roads are required to obtain permits/approval from the state, county, or city maintaining those roadways. No permit loads shall be allowed over posted bridges. The first step in evaluating a permit is to determine if the configuration meets [RCW 46.44](#) for maximum gross weight, load per axle, or axle group. The second step is to evaluate the structures on the traveled route. This can be accomplished in two methods.

The first method, which is more precise for a specific structure, is to model the permit load moving on the bridge and calculating its load rating factor. A single lane distribution factor can be used in the model, which means that no other trucks are permitted in the adjacent lanes. A rating factor equal to or above 1 means the permit truck can safely travel over the particular structure. Permit loads that have unusual configuration or have more than 8 tires per axles shall be evaluated using this method.

The second method is more general and the engineer shall be extremely cautious when applying it to ensure that the permit load is enveloped by one of the typical rated trucks. The method calculates the maximum weight per axle allowed over a bridge and is dependent on the load rating factors for the particular structure, as follows:

- **Truck Type SA**

Definition: Construction Equipment Tires (a.k.a., Super Single Axle) ([RCW 46.44.091\(3\)](#))

Range: Up to 45,000 lbs. per axle.

Criteria: Using the Load Rating Factor for the AASHTO2 Truck (a.k.a., Type 3S2), which has a dual axle weighing 31,000 lbs., the equation is **45,000 lbs. * Rating Factor * 31/45** rounded to the nearest 500 lbs.

- **Collection Truck ([RCW 46.44.041](#)) Restriction List**

Truck Type S/A

Definition: Two-axle trucks where the rear drive axle is the item in question on non-interstate routes only.

Range: Up to 26,000 lbs. on rear axle.

Criteria: Using the Load Rating Factor for the AASHTO1 Truck (a.k.a., Type 3), which has a dual axle weighing 34,000 lbs., the equation is **26,000 lbs. * Rating Factor * 26/34** rounded to the nearest 500 lbs.

- **Truck Type T/D**

Definition: Three-axle trucks where the rear tandem drive axles are the item in question on non-interstate routes only.

Range: Up to 42,000 lbs. on rear dual.

Criteria: Using the Load Rating Factor for the AASHTO1 Truck (a.k.a., Type 3), which has a dual axle weighing 34,000 lbs., the equation is **42,000 lbs. * Rating Factor * 34/42** rounded to the nearest 500 lbs.

- **Tow Truck ([RCW 46.44.015](#)) Restriction List**

Truck Type: Tow truck with tandem (dual) drive axles.

Definition: Three axle tow truck with tandem drive axles towing a variety of vehicles.

Range: Up to 48,000 lbs. on drive dual axles.

Criteria: Using the Load Rating Factor for the AASHTO2 Truck (a.k.a., Type 3S2), which has dual weighing 31,000 lbs., the equation is **48,000 lbs. * Rating Factor * 31/48** rounded to the nearest 500 lbs.

- **Truck Type CL8**

Definition: Class 8 Short Hitch five-axle combination (three-axle tractor with a two-axle trailer).

Range: Up to 21,500 lbs. per axle in dual group and 20,000 to 22,000 for a single axle.

Criteria: Use the Load Rating Factor for the OL1 Truck based on single lane distribution factor. The equation is **22,000 lbs. * Rating Factor** rounded to the nearest 500 lbs.

- **Truck Type BL**

Definition: Big load six plus axle combination and three to four axle single units.

Range: Up to 22,000 lbs. per axle in dual and triaxle groups and up to 22,000 lbs. for a single axle.

Criteria: Use the Load Rating Factor for the OL2 Truck based on a single lane distribution factor. The equation is **22,000 lbs. * Rating Factor** rounded to the nearest 500 lbs. In some instances engineering judgment may be used in establishing restrictions on a structure.

5.03 Scour Evaluation

All bridges spanning waterways are required by the NBIS to have a scour evaluation. A scour evaluation is done to identify the susceptibility to erosion of streambed material and the degree of foundation element stability. The evaluation should include as-built foundation details, current condition of the foundation, a stream bed cross section profile, and stream flow rates. Scour evaluations are site specific and additional information may be required to do an accurate analysis.

As the bridge foundation condition changes and/or the stream bed characteristics change, the scour criticality may have to be reanalyzed.

Upon determining that a bridge is scour critical, the agency needs to develop a written plan of action (POA) to monitor, mitigate, or close the bridge. Monitoring the structural performance of the bridge during and after flood events is particularly important. For additional information, see FHWA HEC 18 Evaluating Scour at Bridges.

A. Determining Susceptibility to Scour

Each bridge's susceptibility to scour damage must be determined to be either:

1. Stable for calculated scour conditions (scour code 8, 7, 5, 4).
2. Scour critical (scour code 3, 2, 1, 0).
3. Scour risk cannot be determined due to unknown foundations.
4. Tidal water that has not been evaluated for scour, but considered low risk (appropriate scour code or code 3 if foundations are unknown).

See FHWA coding guide revision at www.fhwa.dot.gov/engineering/hydraulics/policymemo/revguide.cfm.

The results of the scour evaluation are to be recorded by the scour engineer in the Scour Summary Sheet and to be placed in the scour files. Upon completion of all scour evaluations, there should not be any bridges with a code "6." The completed scour evaluations, information required to do the evaluation, and the best mitigation option for the bridge in question are to be incorporated into the permanent bridge file.

All scour critical bridges should receive soundings at least every 24 months. In addition certain bridges may need soundings after a major flood event.

B. Action Plans for Scour Critical Bridges

For each bridge that has been determined to be scour critical, a POA shall be developed to identify the appropriate measures necessary to make the bridge less vulnerable to damage or failure due to scour. The two primary components of the POA are instructions regarding the type and frequency of inspections to be made at the bridge, and a schedule for the timely design and construction of scour countermeasures (see [Section 5.04](#) for WSDOT and FHWA POA templates)

The POA should include:

- Physical site identification (bridge, route, stream, etc.)
- Hydrologic and Hydraulic Characteristics
- Party responsible for decision on closure/reopen
- Responsible party contact information
- Trigger mechanisms for closure and opening
- Detour routes
- Communication to public (detour signage, law enforcement, press, etc.)

When monitoring is deemed appropriate there are basic components that should be incorporated as listed above. Depending on the risk or consequence of failure, greater detail may be warranted.

Monitoring – It is important that all scour critical bridges be monitored during and after flood events. The POA should include specific instructions to bridge inspectors or maintenance workers on what to look for, at what locations, and methods of inspection to use. Guidance should also be included as to when a bridge should be closed to traffic. Agencies should also develop and inform appropriate personnel of bridge closure procedures. The intensity of the monitoring effort is related to the risk of the scour hazard, as determined from the scour evaluation. Some of the items to consider when developing the monitoring plan include:

- Amount of existing rotational movement or settlement of substructure units
- Degree of streambed degradation, aggradation, or lateral movement
- Recommended procedures and equipment for taking measurements of streambed elevations (rods, probes, weights, portable sonic equipment, etc.)
- Instructions for inspecting existing countermeasures such as riprap, dikes, barbs, mats, etc.
- Guidance on maximum permissible scour depths, flood flows, water surface elevations, etc. beyond which the bridge should be closed to traffic
- Instructions for checking the operation of fixed scour monitoring devices
- Reporting procedures for conditions that warrant bridge closure. Establish the chain of command with authority to close bridges.
- Forms and procedures for documenting inspection results and instructions regarding follow-up actions when necessary

Temporary Countermeasures – Temporary countermeasures provide a degree of protection for scour critical bridges. They may prevent damage for most flows, but are sacrificial, low-cost treatments that help insure the safety of a bridge during flood events. Use of such measures may postpone the need to close a bridge during high flows. Temporary countermeasures, such as riprap, should not be viewed as an alternative to monitoring, but rather as a supplement.

Permanent Countermeasures – Permanent countermeasures are engineered to make a bridge safe from damage due to scour. A variety of methods exist including channel improvements, structural strengthening or underpinning, drop structures, relief bridges or constructing additional spans. These types of fixes would eliminate the bridge from being “scour critical,” but are more costly. Agencies prioritize permanent countermeasures to address the most critical needs as funds permit.

C. Recording Bridge Scour Information

The completed bridge scour evaluation shall include the resulting WB76-80 scour code, the information required to do the evaluations, and the written action plan to mitigate scour risk. The evaluation is to be incorporated into the permanent bridge file for the bridge. Any changes to bridge inventory data should be accomplished within 30 days after the evaluation or field review are complete. The scour monitoring information or schedule should be communicated to all affected parties.

Fields that relate to bridge hydraulics and/or scour are:

- Waterway Adequacy Appraisal- WB 76-62 [71]
- Substructure Condition - WB 76-76 [60]
- Channel Protection - WB 76-77 [61]
- Pier/Abutment Protection – WB 76-79 [111]
- Scour – WB 76-80 [113]

D. Scour Analysis

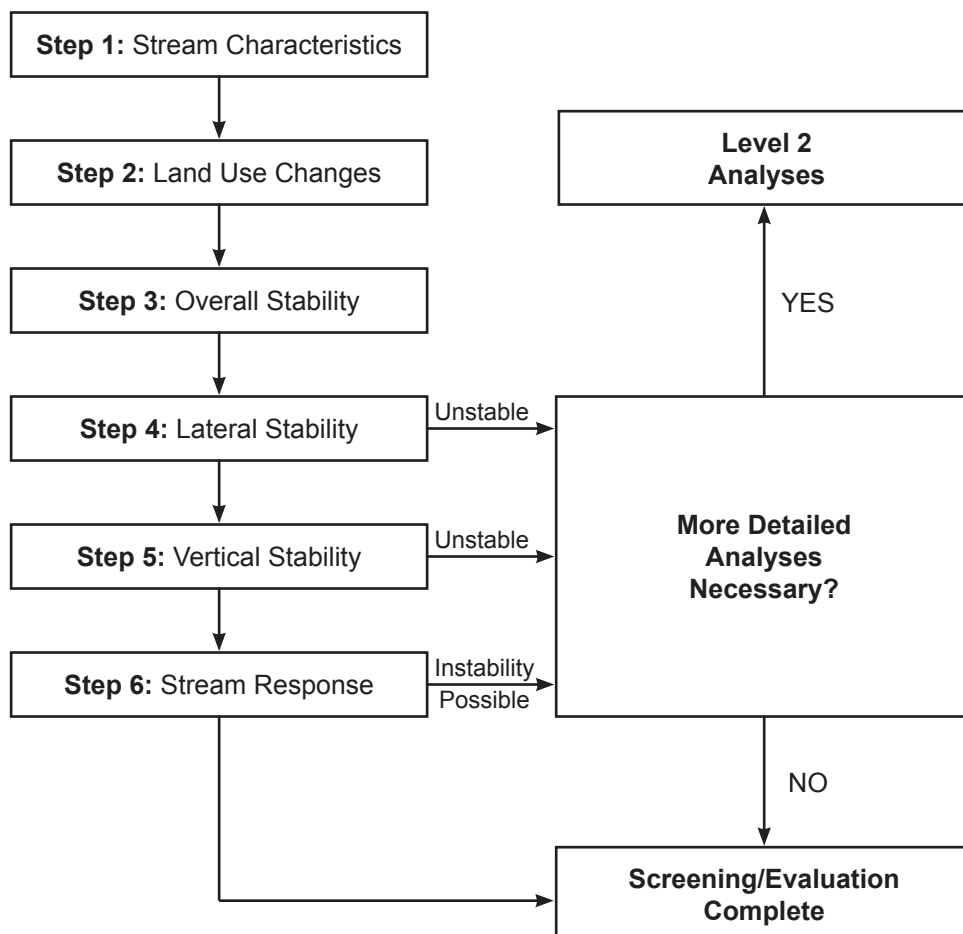
The general solution procedure for analyzing stream stability and scour involves the following three levels of analysis:

- **Level 1** – Application of simple geomorphic concepts and other qualitative analyses
- **Level 2** – Application of basic hydrologic, hydraulic and sediment transport engineering concepts.
- **Level 3** – Application of mathematical or physical modeling studies

Data Needs for Level 1 Qualitative and Other Geomorphic Analyses – The data required for preliminary stability analyses include maps, aerial photographs, notes, and photographs from field inspections, historic channel profile data, information on man’s activities, and changes in stream hydrology and hydraulics over time.

A flowchart of the typical steps in qualitative geomorphic analyses is provided in [Figure 5-1](#).

The six steps are generally applicable to most stream stability problems. As shown in the figure, the qualitative evaluation leads to a conclusion regarding the need for more detailed (Level 2) analysis or a decision to complete a screening or evaluation based on the Level 1 analysis. A Level 1 qualitative analysis is a prerequisite for a Level 2 engineering analysis for bridge design or rehabilitation.



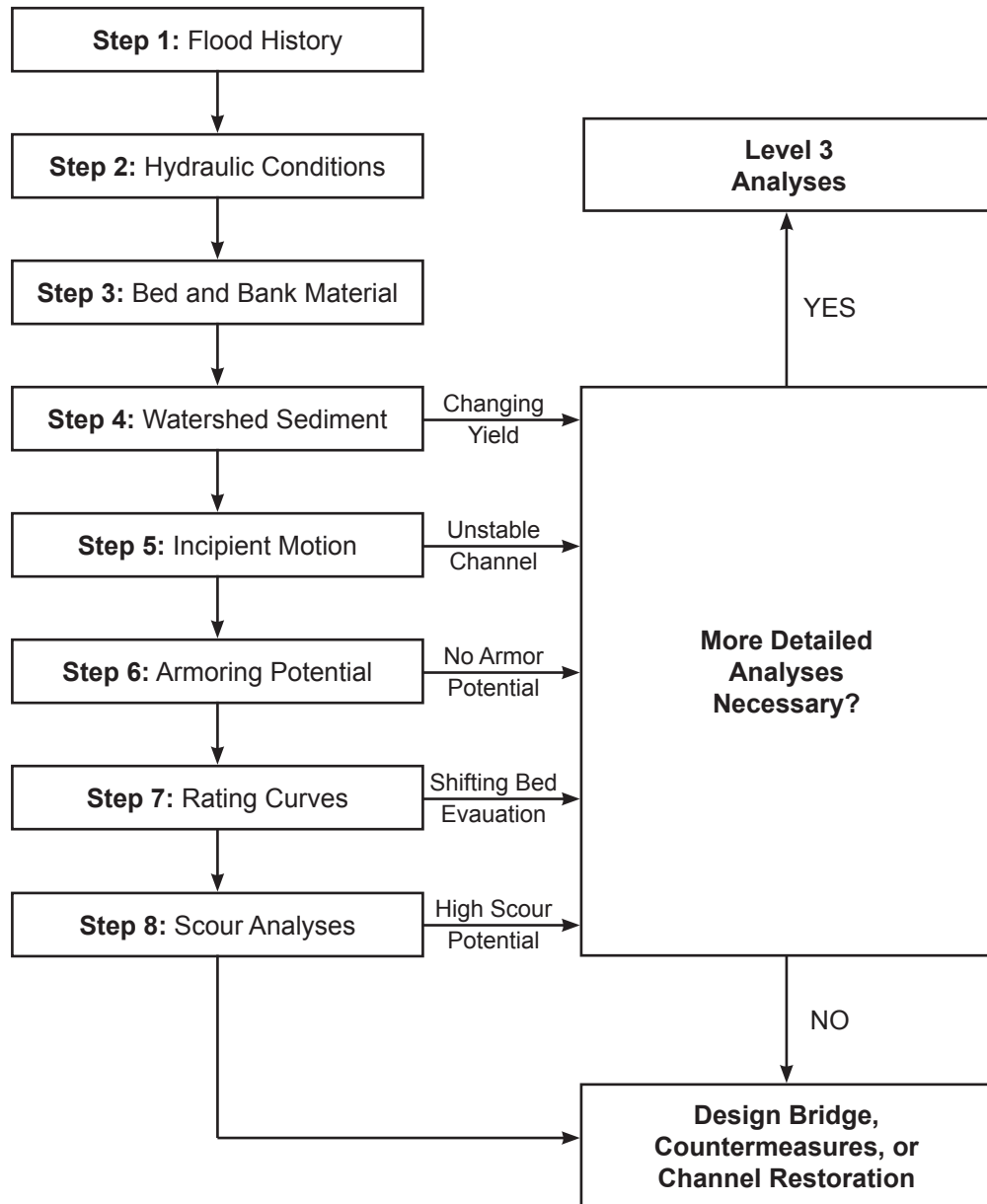
Level 1 Analysis

Figure 5-1

Data Needs for Level 2 Basic Engineering Analyses – Data requirements for basic hydrologic, hydraulic and sediment transport engineering analyses are dependent on the types of analyses that must be completed. Hydrologic data needs include dominant discharge (or bankfull flow), flow duration curves, and flow frequency curves. Hydraulic data needs include cross sections, channel and bank roughness estimates, channel alignment, and other data for computing channel hydraulics, up to and including water surface profile calculations. Analysis of basic sediment transport conditions requires information on land use, soils, geologic conditions, watershed and channel conditions, and available measured sediment transport rates (e.g., from USGS gauging stations).

More detailed quantitative analyses require data on the properties of bed and bank materials and field data on bed-load and suspended-load transport rates. Properties of bed and bank materials that are important to a study of sediment transport include size, shape, fall velocity, cohesion, density, and angle of repose.

Level 3 analyses are generally performed by qualified hydraulic engineers (see [Figure 5-2](#)).



Level 2 Analysis
Figure 5-2

5.04 Appendices

Appendix 5.04-A	WSDOT Plan of Action Template
Appendix 5.04-B	FHWA Plan of Action Template
Appendix 5.04-C	Instructions for Completing the Plan of Action

SCOUR CRITICAL BRIDGE - PLAN OF ACTION

Structure ID	Brg No	Bridge Name
Region	Route	Mile Post
Owner	Last Inspection Date	
Waterway	Brg Length	Main Span Appr Spans
Foundations:		Date POA Modified:
Subsurface soil information: <input type="checkbox"/> Non-Cohesive <input type="checkbox"/> Cohesive <input type="checkbox"/> Rock		Modified By:
		Title:
Does the bridge provide service to emergency facilities and/or an evacuation route? <input type="checkbox"/> <input type="checkbox"/> N/A		

SCOUR VULNERABILITY

NBIS coding :

Scour Code NBIS	Item 113 WS 680
Substructure NBIS	Item 60 WS 676
Channel Protection	Item 60 WS 677
Waterway Adequacy	Item 71 WS 662

Source of Scour Rating ☐ Observed ☐ Assessment ☐ Calculated

Scour
Evaluation
Summary:

9 Note:

361 Note:

677 Note:

680 Note:

Scour Critical Elements:

RECOMMENDED ACTION(S)

a. Flood Monitoring Program	<input type="checkbox"/> Yes <u>Recommended</u> <input type="checkbox"/> No	<input type="checkbox"/> Yes <u>Implemented</u> <input type="checkbox"/> No
b. Hydraulic/Structural Countermeasures	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

MONITORING PROGRAM

☐ Regular Inspection Program ☐ w/ cross sections
Items to Watch:

☐ Underwater Inspection Program
Items to Watch:

☐ Flood Monitoring Program ☐ Visual Inspection

☐ Flood monitoring required during event:

Flood monitoring event defined by (check all that apply):

<input type="checkbox"/> Discharge	<input type="checkbox"/> Stage
<input type="checkbox"/> Elevation measured from	
<input type="checkbox"/> Flood warning system:	

Frequency of flood monitoring:

Post-flood monitoring required: ☐ within

Frequency of post-flood monitoring:

Criteria for termination of flood monitoring:

Agency and Department responsible for monitoring:

Contact
Number

COUNTERMEASURE RECOMMENDATIONS

Countermeasure
implementation
project type:

Contact person:

Target design completion date:

Target construction completion date:

Countermeasures
already completed:

BRIDGE CLOSURE PLAN

Scour monitoring criteria for consideration of bridge closure:

Agency and department responsible for closure:

Closure contact name:

Criteria for reopening the bridge:

Person responsible for Re-opening bridge after inspection:

DETOUR ROUTE

Detour route description (route number, from/to, distance from bridge, etc.) :

Bridges on Detour Route:

Traffic control equipment (detour signing and barriers) and locations(s):

News release, other public notice (include authorized person(s), information to be provided and limitations):

Scour Files (From BEIST)

SCOUR CRITICAL BRIDGE - PLAN OF ACTION		
1. GENERAL INFORMATION		
Structure number: _____	City, County, State: _____	Waterway: _____
Structure name: _____	State highway or facility carried: _____	Owner: _____
Year built: _____	Year rebuilt: _____	Bridge replacement plans (if scheduled): _____ Anticipated opening date: _____
Structure type: <input type="checkbox"/> Bridge <input type="checkbox"/> Culvert		
Structure size and description: _____		
Foundations: <input type="checkbox"/> Known, type: _____ Depth: _____ <input type="checkbox"/> Unknown		
Subsurface soil information (<i>check all that apply</i>): <input type="checkbox"/> Non-cohesive <input type="checkbox"/> Cohesive <input type="checkbox"/> Rock		
Bridge ADT: _____	Year/ADT: _____	% Trucks: _____
Does the bridge provide service to emergency facilities and/or an evacuation route (Y/N)? _____ If so, describe: _____		
2. RESPONSIBILITY FOR POA		
Author(s) of POA (name, title, agency/organization, telephone, pager, email): _____		
Date: _____		
Concurrences on POA (name, title, agency/organization, telephone, pager, email): _____		
POA updated by (name, title, agency, organization): _____ Date of update: _____ Items update: _____		
POA to be updated every _____ months by (name, title, agency/organization): _____ Date of next update: _____		
3. SCOUR VULNERABILITY		
a. Current Item 113 Code: <input type="checkbox"/> 3 <input type="checkbox"/> 2 <input type="checkbox"/> 1 Other: _____		
b. Source of Scour Critical Code: <input type="checkbox"/> Observed <input type="checkbox"/> Assessment <input type="checkbox"/> Calculated Other: _____		
c. Scour Evaluation Summary: _____		
d. Scour History: _____		

4. RECOMMENDED ACTION(S) (see Sections 6 and 7)

	<u>Recommended</u>		<u>Implemented</u>	
a. Increased Inspection Frequency	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
b. Fixed Monitoring Device(s)	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
c. Flood Monitoring Program	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No
d. Hydraulic/Structural Countermeasures	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> No

5. NBI CODING INFORMATION

	<u>Current</u>	<u>Previous</u>
Inspection date		
Item 113 Scour Critical		
Item 60 Substructure		
Item 61 Channel & Channel Protection		
Item 71 Waterway Adequacy		
Comments: (drift, scour holes, etc. - depict in sketches in Section 10)		

6. MONITORING PROGRAM

- ☐ **Regular Inspection Program** ☐ w/surveyed cross sections
Items to Watch: _____
- ☐ **Increased Inspection Frequency of __ mo.** ☐ w/surveyed cross sections
Items to Watch: _____
- ☐ **Underwater Inspection Required**
Items to Watch: _____
- ☐ **Increased Underwater Inspection Frequency of __ mo.**
Items to Watch: _____
- ☐ **Fixed Monitoring Device(s)**
Type of Instrument: _____
Installation location(s): _____
Sample Interval: ☐ 30 min. ☐ 1 hr. ☐ 6 hrs. ☐ 12 hrs. ☐ Other: _____
Frequency of data download and review: ☐ Daily ☐ Weekly ☐ Monthly ☐ Other _____
Scour alert elevation(s) for each pier/abutment: _____
Scour critical elevations(s) for each pier/abutment: _____
Survey ties: _____
Criteria of termination for fixed monitoring: _____

☐ **Flood Monitoring Program**

Type: ☐ Visual inspection
☐ Instrument (*check all that apply*):
☐ Portable ☐ Geophysical ☐ Sonar ☐ Other: _____
 Flood monitoring required: ☐ Yes ☐ No
 Flood monitoring event defined by (*check all that apply*):
☐ Discharge _____ ☐ Stage _____
☐ Elev. measured from _____ ☐ Rainfall _____ (in/mm) per _____ (hour)
☐ Flood forecasting information: _____
☐ Flood warning system: _____
 Frequency of flood monitoring: ☐ 1 hr. ☐ 3 hrs. ☐ 6 hrs. ☐ Other: _____
 Post-flood monitoring required: ☐ No ☐ Yes, within _____ days
 Frequency of post-flood monitoring: ☐ Daily ☐ Weekly ☐ Monthly ☐ Other: _____
 Criteria for termination of flood monitoring: _____
 Criteria for termination of post-flood monitoring: _____
 Scour alert elevation(s) for each pier/abutment: _____
 Scour critical elevation(s) for each pier/abutment: _____

Note: Additional details for action(s) required may be included in Section 8.

Action(s) required if scour alert elevation detected (*include notification and closure procedures*): _____

Action(s) required if scour critical elevation detected (*include notification and closure procedures*): _____

Agency and department responsible for monitoring: _____

Contact person (include name, title, telephone, pager, e-mail): _____

7. COUNTERMEASURE RECOMMENDATIONS

Prioritize alternatives below. Include information on any hydraulic, structural or monitoring countermeasures.

☐ **Only monitoring required (see Section 6 and Section 10 – Attachment F)**
 Estimated cost \$ _____

☐ **Structural/hydraulic countermeasures considered (see Section 10, Attachment F):**

<u>Priority Ranking</u>	<u>Estimated cost</u>
(1) _____	\$ _____
(2) _____	\$ _____
(3) _____	\$ _____
(4) _____	\$ _____
(5) _____	\$ _____

Basis for the selection of the preferred scour countermeasure: _____

Countermeasure implementation project type:

☐ Proposed Construction Project ☐ Maintenance Project
☐ Programmed Construction - Project Lead Agency:
☐ Bridge Bureau ☐ Road Design ☐ Other _____

Agency and department responsible for countermeasure program (if different from Section 6 contact for monitoring): _____

Contact person (include name, title, telephone, pager, e-mail): _____

Target design completion date: _____

Target construction completion date: _____

Countermeasures already completed: _____

8. BRIDGE CLOSURE PLAN

Scour monitoring criteria for consideration of bridge closure:

- ☐ Water surface elevation reaches _____ at _____
☐ Overtopping road or structure
☐ Scour measurement results / Monitoring device (See Section 6)
☐ Observed structure movement / Settlement
☐ Discharge: _____ cfs/cms
☐ Flood forecast: _____
☐ Other: ☐ Debris accumulation ☐ Movement of riprap/other armor protection
☐ Loss of road embankment

Emergency repair plans (include source(s), contact(s), cost, installation directions): _____

Agency and department responsible for closure: _____

Contact persons (name, title, agency/organization, telephone, pager, email): _____

Criteria for re-opening the bridge: _____

Agency and person responsible for re-opening the bridge after inspection: _____

9. DETOUR ROUTE

Detour route description (route number, from/to, distance from bridge, etc.) - Include map in Section 10, Attachment E.

Bridges on Detour Route:

Bridge Number	Waterway	Sufficiency Rating/ Load Limitations	Item 113 Code

Traffic control equipment (detour signing and barriers) and location(s): _____

Additional considerations or critical issues (susceptibility to overtopping, limited waterway adequacy, lane restrictions, etc.) : _____

News release, other public notice (include authorized person(s), information to be provided and limitations): _____

10. ATTACHMENTS

Please indicate which materials are being submitted with this POA:

- ☐ Attachment A: Boring logs and/or other subsurface information
- ☐ Attachment B: Cross sections from current and previous inspection reports
- ☐ Attachment C: Bridge elevation showing existing streambed, foundation depth(s) and observed and/or calculated scour depths
- ☐ Attachment D: Plan view showing location of scour holes, debris, etc.
- ☐ Attachment E: Map showing detour route(s)
- ☐ Attachment F: Supporting documentation, calculations, estimates and conceptual designs for scour countermeasures.
- ☐ Attachment G: Photos
- ☐ Attachment H: Other information: _____

The existing bridge management system in your state will provide much of the information required to fill out this template. Note that all blocks in this template will expand automatically to allow as much space as you require. All fields can be modified to accommodate local terminology, as desired. Where check boxes are provided, they can be checked by double-clicking on the box and selecting the “checked” option. If you include additional attachments, please indicate this in Section 10.

Section 1

Foundations – It is recommended that substructure depths be shown in the bridge elevation, Attachment C (see Section 10). The minimum depth should be reported in Section 1 as a worst-case condition.

Subsurface Soil Information – If conditions vary with depth and/or between substructure units, this should be noted and included in Attachments A and/or C (see Section 10).

Sections 1, 2, 3, and 4

These sections are intended as an executive summary for the reviewer/manager who may not need the details of Sections 5 through 10, and show:

- **Section 1** – General information
- **Section 2** – Who prepared the POA
- **Section 3** – The source of the problem
- **Section 4** – What actions are recommended and their status

Section 3

Reasons why the bridge has been rated scour critical for Item 113:

Scour Critical

- Aggressive stream or tidal waterway (high velocity, steep slope, deep flow).
- Actively degrading channel.
- Bed material is easily eroded.
- Large angle of attack ($> 10^\circ$).
- Significant overbank or floodplain flow (floodplain > 50 m or 150 feet wide).
- Possibility of bridge overtopping (potential for pressure flow through bridge).
- Evidence of scour and/or degradation.
- Evidence of structural damage due to scour.
- Foundations are spread footings on erodible soil, shallow piles, or embedment unknown.
- Exposed footing in erodible material.
- Exposed piles with unknown or insufficient embedment.
- Loss of abutment and/or pier protection.
- No countermeasures or countermeasures in poor condition.
- Needs countermeasures immediately.

Unknown Foundations

- No record of foundation type (spread footing vs. piles).
- Depth of foundation or pile embedment unknown.
- Condition of foundation or pile embedment unknown.
- Subsurface soil strata not documented.

Section 5

This section highlights recent changes in the scour/hydraulics coding items as an indication of potential problems or adverse trends. See FHWA Policy Memorandum on Revision of Coding Guide, Item 113 - Scour Critical Bridges dated April 27, 2001, for details on Items 113 and 60 which can be found at www.fhwa.dot.gov/engineering/hydraulics/policymemo/revguide.cfm.

Section 6

Multiple individuals responsible for various monitoring activities may be listed, as appropriate.

Section 7

Guidance on the selection and design of scour countermeasures may be found in FHWA Hydraulic Engineering Circular No. 23, Bridge Scour and Stream Instability Countermeasures, Second Edition, 2001. To facilitate the selection of alternative scour countermeasures, a matrix describing the various countermeasures and their attributes is presented in this circular and can be found at <http://isddc.dot.gov/olpfiles/fhwa/010592.pdf>.

Section 8

Standard closure and reopening procedures, if available, may be appended to the POA (see Section 10, Attachment H).

Section 9

In some situations, public transportation (e.g., bus routes) may be of importance to the public, and therefore could be included in the POA (see Section 10, Attachment).